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EXAMINER	
NGUYEN, PHUONGCHAU BA	
ART UNIT	PAPER NUMBER
2616	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	09/992,677	VENKATACHARY ET AL.	
	Examiner	Art Unit	
	Phuongchau Ba Nguyen	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *1-24-7*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *14 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3-1-7*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Drawings

1. The drawings are objected to because all blocks in figures 1-3 should be labeled with descriptive legends (i.e., block 10 should be labeled as 10-Packet Matching System). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes

are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 2-4, 5-12, 14-20, 22-24 are objected to because of the following informalities:

-Claims 2-4, 6-12, 14-20, 22-24, line 1,

"invention" should be changed to ---method---;

-Claim 5, line 12,

"such that" should be changed to --- by---

-Claim 20, line 5,

"such" should be changed to ---so---.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: "selecting a single best matching rule from the outputs of the Best Matching Rules sub-Engines" from the collate engine 104-fig.1 for selecting a single best matching rule from the outputs of the Best Matching Rules sub-Engines 102 (specification, page 4, 4th paragraph).

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4, 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Gupta (Packet Classification on Multiple Fields).

Regarding claim 1,

Gupta (Packet Classification on Multiple Fields) discloses a Packet Matching method, the method comprising:

(a) providing a Rule Database (CAM) comprising a plurality of classification rules (matching rules), and providing a packet comprising a packet header to be classified (5th paragraph, page 1, and 4-Previous Work);

(b) creating a plurality of sub-databases (tables) from the plurality of classification rules (matching rules) in the Rule Database (4-Previous Work);

(c) creating a plurality of Necessary Path Condition Rules (matching rules) wherein each Necessary Path Condition Rule (a matching rule) corresponds to a sub-database (table)(tables 1-2, 1-introduction; 2-The problem of Packet Classification; 4-Previous Work);

(d) determining which sub-databases to search (i.e., flow classifier determined which flow (i.e., sub-database) an arriving packet belongs to, see 1-Introduction, 1st paragraph, lines 4-5), said determining further comprising comparing at least some of the packet header (i.e., contents of packet header(s), see 1-Introduction, 1st paragraph, lines 10-12) to the plurality of Necessary Path Condition Rules (i.e., a Set of Rules, see 1-Introduction, lines 8-

12, and table 2 wherein the classes that the router classified an incoming packet into);

(e) searching the sub-databases determined in step (d) for best matching classification rules (1-Introduction; 2-The problem of Packet Classification; 4-Previous Work); and

(f) selecting the best matching classification rule (1-Introduction; 2-The problem of Packet Classification; 4-Previous Work).

Regarding claim 2,

Gupta further discloses wherein the searching in (e) comprises searching in parallel (4-Previous Work).

Regarding claim 3,

Gupta further discloses (g) providing an additional packet to be classified; and (h) matching the additional packet according to steps (d), (e), and (f) (i.e., the header of each packet is examined to identify the flow to which the packet

belongs in 1-Introduction; see also 2-The problem of Packet Classification; 4-Previous Work).

Regarding claim 4,

Gupta further discloses wherein the sub-databases comprise at least T/3 classification rules, and wherein the sub-databases further comprise up to T classification rules (2.1-Examples of a Classifier, number 2).

Regarding claim 21,

Gupta (Packet Classification on Multiple Fields) discloses a Packet Matching system comprising:

means for creating a plurality of sub-databases (i.e., which flow in table 1) from a plurality of rules (i.e., set of rules in table 2);

means for determining which sub-databases (i.e., which flow) to search given a packet (of an arriving packet belongs to, see 1-Introduction, lines 4-8; and see also table 2);

means for finding best rule (i.e., one rule in a set of rules of the flow classifier, where each flow obeys at least one rule, see 1-Introduction, lines 4-18) matches among the determined sub-databases (flows/rules in tables 1-2) for the packet; and

means for selecting the highest priority best matching rule from among the found best rule matches (i.e., selecting which rules closer to the top of the list take priority, see 5th paragraph on page 1).

7. Claim 13 is rejected under 35 U.S.C. 102(e) as being anticipated by Kansal (6,374,326).

Regarding claim 13,

Kansal (6,374,326) discloses a Packet Matching system (fig.2), the system comprising:

an All Matching Rules Engine (bank key generator 260-fig.2) to generate, based on a first subset of bits (i.e., 143:72 or 71:0) within a search value (i.e.,

input key, see fig.3), selection signals (i.e., bank keys for sub-bank A or sub-bank B, figs.2-3) that indicate which of a plurality of sub-databases (sub-banks A & B) are to be searched for a match to a second subset of bits within the search value (see figs. 2-3);

a plurality of Best Matching Rules Sub-Engines (cam subbank A, cam subbank B, fig.3) to store the plurality of sub-databases and to search the sub-databases by the selection signals for a match to the second subset of bits within the search value, see col.3, lines 43-52; and

a Collate Engine (size selection logic 220-figs. 2 & 3b) coupled to said Best Matching Rules sub-engines (cam subbank A, cam subbank B, figs. 2-3).

8. Claims 5-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Gupta (Packet Classification using Hierarchical Intelligent Cuttings).

Regarding claim 5,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses a method for organizing a Rule Database, the method comprising:

(a) providing a Rule Database (Ternary CAM) comprising a plurality of N classification rules, each classification rule comprising W bits, wherein each bit of the W bits has a value selected from the group consisting of 0, 1, and X (3-Related Work);

(b) constructing a hierarchical subdivision tree (fig.2), comprising a single root (i.e., 256*256, X, 4), a plurality of nodes (i.e., R1-R2, R2 & R6, R2 & R7), and a plurality of leaves (i.e., R4 & R5, R2 & R3), wherein the root, the nodes, and the leaves are interconnected by a plurality of branches, wherein each branch corresponds to a value of a bit of the W bits of at least some of the plurality of the N classification rules (fig.2, 4-Packet Classification using Hierarchical Intelligent Cutting); and

(c) creating a plurality of sub-databases such that traversing, via at least some of the branches, any path from the root of the hierarchical subdivision tree through at least some of the interconnected nodes to a leaf of the plurality of leaves will lead to a sub-database, wherein each sub-database comprises a subset of up to T classification rules (subset of rules R(u)) of the plurality of N

classification rules (set of rules R(v)), and wherein each of the plurality of the N classification rules is a member of exactly one sub-database (fig.2, 4-Packet Classification using Hierarchical Intelligent Cutting).

Regarding claim 6,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses wherein each sub-database further comprises a subset of at least Tmin classification rules (subset of rules R(u)) of the plurality of N classification rules (set of rules R(v)) (fig.2, 4-Packet Classification using Hierarchical Intelligent Cuttings).

Regarding claim 7,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses wherein Tmin is less than or equal to T/3 (table 1, 4-Packet Classification using Hierarchical Intelligent Cuttings).

Regarding claim 8,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses creating a plurality of Necessary Path Condition Rules wherein each of the Necessary Path Condition Rules corresponds to a sub-database, and wherein each of the Necessary Path Condition Rules of the plurality of the Necessary Path Condition Rules is comprised of the bit values associated with each traversed branch of the hierarchical subdivision tree while traversing the hierarchical subdivision tree from the root to the corresponding exactly one sub-database (fig.2, 4-Packet Classification using Hierarchical Intelligent Cuttings).

Regarding claim 9,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses wherein N is at least around 10,000 (3-Related Work, 9th paragraph).

Regarding claim 10,

Gupta (Packet Classification using Hierarchical Intelligent Cuttings) discloses wherein W is at least around 32 (table 1).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kansal (6,374,326).

Regarding claim 24, Kansal further discloses a circuitry (i.e., multiplexer 310 or instruction decoder 250, in fig.2) to search the sub-databases indicated by the selection signals (i.e., key bank A) for a match to the first subset of bits (i.e., 143:72) within the search value (i.e., input key-figs.2-3) concurrently with

searching the sub-databases indicated the selection signals (i.e., key bank B(for a match to the second subset of bits (i.e., 71:0) within the search value (i.e., input key-figs. 2-3). However, Kansal does not explicitly disclose "wherein the plurality of Best Matching Rules Sub-Engines includes circuitry".

Kansal further discloses the multiple bank CAM extracting one or more distinct subsets of the bits in the input key for use as bank lookup keys, see col.2, lines 14-19, corresponding to (1). Therefore, it would have been obvious to an artisan to include the circuitry for using the input key as bank lookup keys with the motivation being to fasten the lookup time in communication routing and switching.

11. Claims 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kansal (6,374,326) as applied to claim 13 above, and further in view of Gupta (Packet Classification on Multiple Fields).

Regarding claim 14, Kansal discloses all the claimed limitations, except (1) wherein said All Matching Rules Engine (multiple cam bank 200-fig.2) further comprises a memory comprising a set of Necessary Path Condition Rules.

However, in the same field of endeavor, Gupta discloses wherein said All Matching Rules Engine (multiple cam bank 200-fig.2) further comprises a memory comprising a set of Necessary Path Condition Rules (tables 1-3, 2-The Problem of Packet Classification & 2.1-Example of a Classifier), corresponding to (1). Therefore, it would have been obvious to an artisan to apply Gupta's teaching to Kansal's system with the motivation being to perform classification quickly on an arbitrary number of fields for fast routing lookup.

Regarding claim 15, Kansal further discloses said memory comprising at least one of the following memories: CAM, DRAM, SRAM (figs. 2-3).

Regarding claim 16, Kansal discloses wherein each of said Best Matching Rules sub-engine (CAM 200-fig.2) further comprises a sub-database memory (cam

bank 210-fig.2) to store at least one sub-database (cam subbank A 322-fig.3) of the plurality of sub-databases (cam subbank A, cam subbank B, fig.3), except (1) the at least one sub-database of each of said Best Matching Rules sub-Engines corresponding to said Necessary Path Condition Rules (example of rules, table 1).

However, in the same field of endeavor, Gupta further discloses the at least one sub-database (which flow, see 1-Introduction, 1st paragraph, lines 4-5) of each of said Best Matching Rules sub-Engines (i.e., table 1) corresponding to said Necessary Path Condition Rules (i.e., set of rules, 1-Instrodution, table 1, 1st paragraph, lines 4-5, and lines 8-12, table 2 wherein the classes that the router classified an incoming packet into), corresponding to (1). Therefore, it would have been obvious to an artisan to apply Gupta's teaching to Kansal's system with the motivation being to fasten the packet classification based on a set of rules.

Regarding claim 17, Kansal wherein said sub-database memory (cam subbank A, figs. 2-3) comprises at least one of the following memories: CAM, DRAM, SRAM.

Regarding claim 18, Kansal discloses all the claimed limitations, except (1) wherein said at least one sub-database of the plurality of sub-databases comprises a plurality of rules.

However, in the same field of endeavor, Gupta (Packet Classification on Multiple Fields) discloses wherein said at least one sub-database (which flow, see 1-Introduction, 1st paragraph, lines 4-5) of the plurality of sub-databases (i.e., table 1) comprises a plurality of rules (i.e., set of rules, 1-Introdution, table 1, 1st paragraph, lines 4-5, and lines 8-12, table 2 wherein the classes that the router classified an incoming packet into), corresponding to (1). Therefore, it would have been obvious to an artisan to apply Gupta's teaching to Kansal's system with the motivation being to fasten the packet classification based on a set of rules.

Regarding claim 19, Kansal discloses all the claimed limitations, except (1) wherein said at least one sub-database of the plurality of sub-databases comprises a plurality of forwarding entries.

However, in the same field of endeavor, Gupta (Packet Classification on Multiple Fields) discloses wherein said at least one sub-database (i.e., which flow, see 1-Introduction, 1st paragraph, lines 4-5) of the plurality of sub-databases (i.e., table 1) comprises a plurality of forwarding entries (i.e., entries/set of rules in table 1, see 1st paragraph, lines 4-5, and lines 8-12, table 2 wherein the classes that the router classified an incoming packet into)), corresponding to (1). Therefore, it would have been obvious to an artisan to apply Gupta's teaching to Kansal's system with the motivation being to fasten the packet classification based on a set of rules.

Regarding claim 20, Kansal discloses wherein said plurality of sub-databases (i.e., cam banks) are distributed among said plurality of Best Matching Rules

sub-engines (i.e., subbanks) such (so) that concurrent activation of more than one Best Matching Rules sub-Engine of said plurality of sub-engines is minimized, (see abstract, lines 6-9; col.1, line 66-col.2, line 13-showing simultaneous lookup to the subbanks, emphasis added; see also figure 2 wherein the lookup used the key input to search only the subbank as indicated in the key input-emphasis added, see also fig.3) and all the claimed limitations, except (1) wherein each sub-database of said plurality of sub-databases corresponds to one of said Necessary Path Condition Rules,

However, in the same field of endeavor, Gupta (Packet Classification on Multiple Fields) discloses wherein each sub-database (i.e., which flow, see 1-Introduction, 1st paragraph, lines 4-5) of said plurality of sub-databases (i.e., table 1) corresponds to one of said Necessary Path Condition Rules (i.e., entries/set of rules in table 1, see 1st paragraph, lines 4-5, and lines 8-12, table 2 wherein the classes that the router classified an incoming packet into). corresponding to (1). Therefore, it would have been obvious to an artisan to

apply Gupta's teaching to Kansal's system with the motivation being to fasten the packet classification based on a set of rules.

12. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta (Packet Classification using Hierarchical Intelligent Cuttings) in view of Liu (Reducing Routing Table Size Using Ternary CAM).

Regarding claim 11, Gupta (Packet Classification using Hierarchical Intelligent Cuttings) all the claimed limitations, except (1) inserting an additional rule to a sub-database.

However, in the same field of endeavor, Liu (Reducing Routing Table Size Using Ternary CAM) discloses 3.1-Insertion (corresponding to (1)). Therefore, it would have been obvious to an artisan to apply Liu's teaching to Gupta's system with the motivation being to reduce the compaction ratio over time, results in almost no area savings at all.

Regarding claim 12, Gupta (Packet Classification using Hierarchical Intelligent Cuttings) all the claimed limitations, except (1) deleting an existing rule from a sub-database.

However, in the same field of endeavor, Liu (Reducing Routing Table Size Using Ternary CAM) discloses 3.2-Withdrawal (corresponding to (1)). Therefore, it would have been obvious to an artisan to apply Liu's teaching to Gupta's system with the motivation being to reduce the table size.

13. Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta (Packet Classification on Multiple Fields) in view of Liu (Reducing Routing Table Size Using Ternary-CAM).

Regarding claim 22, Gupta discloses all the claimed limitations, except (1) an optimizing means for creating the plurality of sub-databases such that power dissipation is less than threshold power level.

However, in the same field of endeavor, Liu (Reducing Routing Table Size Using Ternary-CAM) discloses in the 6th paragraph for creating a compact routing table size so that a smaller number of CAM chips can be used in the system (corresponding to (1)). Therefore, it would have been obvious to an artisan to apply Liu's teaching to Gupta's system with the motivation being to reduce its power consumption and heat dissipation.

Regarding claim 23, Gupta discloses all the claimed limitations, except (1) an optimizing means for creating the plurality of sub-databases such that storage requirements of each sub-database of the plurality of sub-databases is less than threshold storage capacity.

However, in the same field of endeavor, Liu (Reducing Routing Table Size Using Ternary-CAM) discloses in the 4-5th paragraphs for creating compact routing table to store separate mask for each entry and to store prefix with different length into separate CAM chip (see table 1). Therefore, it would have

been obvious to apply Liu's teaching to Gupta's system with the motivation being to provide a high lookup throughput.

Response to Arguments

14. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuongchau Ba Nguyen whose telephone number is 571-272-3148. The examiner can normally be reached on Monday-Friday from 10:00 a.m. to 6:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu can be reached on 571-272-3155. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PChau

Phuongchau Ba Nguyen
Examiner
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